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[54] Title: Device and Method to Prevent the Re-adsorption of Micro Particles in Wafer Cleaning Process (by Reducing the Pressure of the Cleaning Tank by a Degassing Pump to Generate Bubbles)

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[57] Claims:

1. A cleaning device in wafer cleaning process, comprising

at least:

a cleaning tank, used as a space for cleaning wafer;

a low-voltage device, for lowering the pressure of said cleaning tank;  
reducing the pressure inside said cleaning tank by said low-voltage device to generate bubbles on a surface of said wafer immersed in a cleaning solution, such that the generated bubbles separate micro particles near said wafer surface from said wafer surface, thereby preventing said separated micro particles from being re-absorbed on said wafer surface due to the repulsion of said generated bubbles.

2. The cleaning device in wafer cleaning process as claimed in claim 1, wherein said cleaning solution in said cleaning tank can be a single solution of ultra pure water or a mixed solution of ultra pure water and chemicals and solvents such as  $\text{NH}_4/\text{H}_2\text{O}_2/\text{H}_2\text{O}$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{HCl}$ ,  $\text{HF}$ ,  $\text{EKC}$ , etc.

3. The cleaning device in wafer cleaning process as claimed in claim 1, wherein said low-voltage device can be a degassing pump or a plant's vacuum line.

4. A device that prevents the re-adsorption of micro particles in the wafer cleaning process, comprising at least:

a cleaning tank, used as a space for cleaning wafer;  
a degassing pump, disposed on said cleaning tank,  
capable of reducing the pressure inside said cleaning tank  
by pumping out the air in said cleaning tank;

a vessel, contains deionized water;

a pipe line, for connecting said vessel to said  
cleaning tank;

reducing the pressure inside said cleaning tank by said  
degassing pump, such that said deionized water in said  
vessel first passes into said cleaning tank and forms  
bubbles on a surface of said wafer and micro particles,  
wherein the generated bubbles separate said micro particles  
near said wafer from said wafer surface, thereby preventing  
said separated micro particles from being re-absorbed on  
said wafer surface due to the repulsion of said generated  
bubbles.

5. The device that prevents the re-adsorption of micro  
particles in wafer cleaning process as claimed in claim 4,  
wherein pressure inside said cleaning tank is approximately  
0.5 to 1 atmospheric pressure (ATM.).

6. The device that prevents the re-adsorption of micro  
particles in wafer cleaning process as claimed in claim 4,  
wherein said pipe line is provided with a valve that

controls the opening or closing of said pipe line.

7. The device that prevents the re-adsorption of micro particles in wafer cleaning process as claimed in claim 4, wherein said cleaning tank is provided with a vent.

8. The device that prevents the re-adsorption of micro particles in wafer cleaning process as claimed in claim 4, wherein said deionized water solution is contained in said cleaning tank capable of megasonic cleaning.

9. The device that prevents the re-adsorption of micro particles in wafer cleaning process as claimed in claim 4, further comprising a plurality of vessels to contain different chemical cleaning solutions when being applied in a single-bath cleaning processor.

10. The device as claimed in claim 9, further comprising a plurality of pipe lines to pass said chemical cleaning solution in said plurality of vessels into said cleaning tank.

11. The device that prevents the re-adsorption of micro particles in wafer cleaning process as claimed in claim 4, further comprising a plurality of vessels to contain

different chemical cleaning solutions when being applied in a spray chemical cleaning processor.

12. The device as claimed in claim 11, comprising a plurality of pipe lines to pass said chemical cleaning solution in said plurality of vessels into said cleaning tank.

13. The device that prevents the re-adsorption of micro particles in wafer cleaning process as claimed in claim 4, further comprising a plurality of cleaning tanks to contain different chemical cleaning solutions when being applied in a wet bench.

14. The device that prevents the re-adsorption of micro particles in wafer cleaning process as claimed in claim 4, wherein said device is a scrubber or a jet system applied for the cleaning process.

15. A device that prevents the re-adsorption of micro particles in wafer cleaning process, comprising at least:

a vessel;

a cleaning tank, used as a space for cleaning wafer;  
a degassing pump, connected on said cleaning tank, with pressure inside said cleaning tank at approximately 0.5 to 1

atmospheric pressure (ATM.);

a drain outlet, disposed on said cleaning tank; and

a pipe line, for connecting said vessel to said cleaning tank, such that deionized water in said vessel first passes into said cleaning tank and forms a plurality of bubbles on a surface of said wafer and micro particles, and the generated bubbles separate said micro particles near said wafer from said wafer surface, thereby preventing said separated micro particles from being re-absorbed on said wafer surface due to the repulsion of said generated bubbles.

16. The device as claimed in claim 15, wherein said deionized water solution is contained in said cleaning tank capable of megasonic cleaning.

17. The device as claimed in claim 15, further comprising a plurality of vessels to contain different chemical cleaning solutions when being applied in a single-bath cleaning processor.

18. The device as claimed in 17, comprising a plurality of pipe lines to pass said chemical cleaning solution in said plurality of vessels into said cleaning tank.

19. The device as claimed in 15, further comprising a

plurality of vessels to contain different chemical cleaning solutions when being applied in a spray chemical cleaning processor.

20. The device as claimed in claim 19, comprising a plurality of pipe lines to pass said chemical cleaning solution in said plurality of vessels into said cleaning tank.

21. The device as claimed in claim 15, further comprising a plurality of cleaning tanks to contain different chemical cleaning solutions when being applied in a wet bench.

22. The device as claimed in claim 15, wherein said device is a scrubber or a jet system applied for the cleaning process.

23. A method that prevents the re-adsorption of micro particles in wafer cleaning process, comprising at least the step of:

providing a vessel, a cleaning tank, a degassing pump, and a pipe line, wherein said pipe line connects said vessel to said cleaning tank, onto which said degassing pump is connected;

providing deionized water in said vessel;

passing said deionized water in said vessel into said cleaning tank; and

pumping out gas from said cleaning tank by said degassing pump to reduce the pressure inside said cleaning tank, such that said deionized water forms bubbles on a surface of said wafer and micro particles, wherein the generated bubbles separate said micro particles near said wafer from said wafer surface, thereby preventing said separated micro particles from being re-absorbed on said wafer surface due to the repulsion of said generated bubbles.

24. The method as claimed in claim 23, wherein the pressure inside said cleaning tank is approximately 0.5 to 1 atmospheric pressure (ATM).

25. The method as claimed in claim 23, wherein said pipe line is provided with a valve that controls the opening or closing of said pipe line.

26. The method as claimed in claim 23, wherein a drain outlet is disposed on said cleaning tank.

27. The method as claimed in claim 23, wherein said deionized water solution is contained in said cleaning tank capable of megasonic cleaning.



28. The method as claimed in claim 23, further comprising a plurality of vessels to contain different chemical cleaning solutions when being applied in a single-bath cleaning processor.

29. The method as claimed in claim 28, comprising a plurality of pipe lines to pass said chemical cleaning solution in said plurality of vessels into said cleaning tank.

30. The method as claimed in claim 23, further comprising a plurality of vessels to contain different chemical cleaning solutions when being applied in a spray chemical cleaning processor.

31. The method as claimed in claim 30, comprising a plurality of pipe lines to pass said chemical cleaning solution in said plurality of vessels into said cleaning tank.

32. The method as claimed in claim 23, further comprising a plurality of cleaning tanks to contain different chemical cleaning solutions when being applied in a wet bench.

33. The method as claimed in claim 23, wherein said method is a cleaning process that applies a scrubber or a jet system.

34. A wafer cleaning method after a hydrofluoric acid etching process, disposing a wafer on a single-bath cleaning processor for cleaning, said method comprising at least the step of:

providing a vessel, a cleaning tank, a degassing pump, and a pipe line, wherein said pipe line connects said vessel to said cleaning tank, onto which said degassing pump is connected;

providing deionized water in said vessel;

passing said deionized water in said vessel into said cleaning tank; and

pumping out gas from said cleaning tank by said degassing pump to reduce the pressure inside said cleaning tank, such that said deionized water forms bubbles on a surface of said wafer and micro particles in said cleaning tank, wherein the generated bubbles separate said micro particles near said wafer from said wafer surface, thereby preventing said separated micro particles from being re-absorbed on said wafer surface due to the repulsion of said generated bubbles; and

containing said deionized water solution in said cleaning

tank capable of megasonic cleaning.

35. The method as claimed in claim 34, wherein said pipe line is provided with a valve that controls the opening or closing of said pipe line.

36. The method as claimed in claim 34, wherein a drain outlet is disposed on said cleaning tank.

**Brief Description of the Drawings:**

FIG. 1 shows a schematic view of the conventional wet bench for the cleaning processor.

FIG. 2 shows a schematic view of the conventional spray chemical cleaning processor.

FIG. 3 shows a schematic view of the conventional single-bath cleaning processor.

FIG. 4 is a schematic view showing the absorption of micro particles on the wafer when removing the wafer on a wet bench according to the conventional cleaning technology.

FIG. 5 is a schematic view showing the formation of bubbles to prevent the re-absorption of micro particles on the wafer surface when cleaning the wafer according to the technology disclosed in the present invention.

FIG. 6 shows a schematic view of a device made according to the technology disclosed in the present invention.

FIG. 7 is a schematic view showing the application of the technology disclosed in the present invention in a single-bath cleaning processor.

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發明

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[54]名 稱：晶圓潔淨製程中防止微粒再附著之裝置及方法

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[57]申請專利範圍：

1.一種晶圓潔淨製程中之清洗裝置，該裝置至少包含：

一潔淨槽，作為洗淨晶圓之空間；

一低壓裝置，係用以降低潔淨槽之壓力；

藉由低壓裝置降低潔淨槽之壓力，使浸泡在一清潔液中的晶圓表面形成氣泡，使靠近晶圓表面的微粒會被氣泡推離該晶圓表面，而已離開晶圓表面的微粒會因氣泡之斥力而不會回沾到該晶圓的表面。

2.如申請專利範圍第1項之裝置，其中上述潔淨槽內之清潔液可為超純水， $\text{NH}_4\text{H}_2\text{O}_2/\text{H}_2\text{O}$ ， $\text{H}_2\text{SO}_4$ ， $\text{HCl}$ ， $\text{HF}$ ， $\text{EKC}$ ，等之化學品，溶劑，超純水之單一或混合溶液。

3.如申請專利範圍第1項之裝置，其中上述之低壓裝置可為抽氣幫浦或吸務之真空管路。

4.一種晶圓潔淨製程中防止微粒再附著

之裝置，該裝置至少包含：

一潔淨槽，係用以洗淨晶圓的地方；

一抽氣幫浦，係位於該潔淨槽上，經由抽取該潔淨槽內的空氣以降低該潔淨槽內之壓力；

一容器，其內含去離子水；

一管路，係用以連接該容器與該潔淨槽；

藉由該抽氣幫浦降低該潔淨槽內之壓力使得該容器內的該去離子水通入該潔淨槽後，在晶圓以及微粒的表面形成多數個氣泡，其中靠近該晶圓的微粒會被氣泡推離該晶圓的表面，而已離開該晶圓表面的微粒會因為氣泡之間的斥力而不會回沾到該晶圓的表面上。

5.如申請專利範圍第4項之裝置，其中上述之潔淨槽內的壓力大小約為0.5到1大氣壓。

20. 6.如申請專利範圍第4項之裝置，在該管

- 路上更包含一閥，用以控制該管路的開關狀態。
- 7.如申請專利範圍第4項之裝置，在該潔淨槽上更包含一出風口。
  - 8.如申請專利範圍第4項之裝置，更包含以超音波震盪位於該潔淨槽內之該去離子水溶液。
  - 9.如申請專利範圍第4項之裝置，當應用在單槽式洗淨機台上更包含多數個容器用以盛裝不同的化學洗淨溶液。
  - 10.如申請專利範圍第9項之裝置，更包含多數個管路用以將該多數個容器內之該化學洗淨溶液通入該潔淨槽內。
  - 11.如申請專利範圍第4項之裝置，當應用在噴洗式化學洗淨機上更包含多數個容器用以盛裝不同的化學洗淨溶液。
  - 12.如申請專利範圍第11項之裝置，更包含多數個管路用以將該多數個容器內之該化學洗淨溶液通入該潔淨槽內。
  - 13.如申請專利範圍第4項之裝置，當應用在濕式洗淨工作台上更包含多數個潔淨槽用以盛裝不同的化學洗淨溶液。
  - 14.如申請專利範圍第4項之裝置，係應用在刷洗機，或噴射系統中的洗濯過程。
  - 15.一種晶圓潔淨製程中防止微粒再附著之裝置，該裝置包含：
    - 一容器；
    - 一潔淨槽，係洗淨晶圓的地方；
    - 一抽氣幫浦，係連結於該潔淨槽上，而該潔淨槽內的壓力大小約為0.5到1大氣壓；
    - 一排液口，係位於該潔淨槽上；及
    - 一管路，係用以連接該容器與該潔淨槽，使得該容器內之一去離子水通入該潔淨槽後，在晶圓以及微粒的表面形成多數個氣泡，而靠近該晶圓的微粒會被氣泡推離該晶圓的表面，而已

- 經離開該晶圓表面的微粒會因為氣泡之間的斥力而不會回沾到該晶圓的表面上。
- 16.如申請專利範圍第15項之裝置，更包含以超音波震盪位於該潔淨槽內之該去離子水溶液。
  - 17.如申請專利範圍第15項之裝置，當應用在單槽式洗淨機台上更包含多數個容器用以盛裝不同的化學洗淨溶液。
  - 18.如申請專利範圍第17項之裝置，更包含多數個管路用以將該多數個容器內之該化學洗淨溶液通入該潔淨槽內。
  - 19.如申請專利範圍第15項之裝置，當應用在噴洗式化學洗淨機上更包含多數個容器用以盛裝不同的化學洗淨溶液。
  - 20.如申請專利範圍第19項之裝置，更包含多數個管路用以將該多數個容器內之該化學洗淨溶液通入該潔淨槽內。
  - 21.如申請專利範圍第15項之裝置，當應用在濕式洗淨工作台上更包含多數個潔淨槽用以盛裝不同的化學洗淨溶液。
  - 22.如申請專利範圍第15項之裝置，係應用在刷洗機，或噴射系統中的洗濯過程。
  - 23.一種晶圓潔淨製程中防止微粒再附著之方法，該方法至少包含：
    - 提供一容器，一潔淨槽，一抽氣幫浦，與一管路，其中該管路係用以連接該容器與該潔淨槽，該抽氣幫浦係連接於該潔淨槽上；
    - 在該容器內提供去離子水；
    - 將該容器內之該去離子水通入該潔淨槽；及
    - 以該抽氣幫浦對該潔淨槽抽氣以降低該潔淨槽內的壓力，使得該去離子水在該潔淨槽中晶圓以及微粒的表面形成氣泡，其中靠近該晶圓的微粒會被氣泡推離該晶圓的表面，而已經離開

該晶圓表面的微粒會因為氣泡之間的斥力而不會回沾到該晶圓的表面上。

24.如申請專利範圍第23項之方法，其中上述該深淨槽內之壓力大小約為0.5到1大氣壓。

25.如申請專利範圍第23項之方法，在該管路上更包含一閥，用以控制該管路的開關狀態。

26.如申請專利範圍第23項之方法，在該深淨槽上更包含一排放口。

27.如申請專利範圍第23項之方法，更包含以超音波震盪位於該深淨槽內之該去離子水溶液。

28.如申請專利範圍第23項之方法，當應用在單槽式洗淨機台上更包含多個容器用以盛裝不同的化學洗淨溶液。

29.如申請專利範圍第28項之方法，更包含多個管路用以將該多個容器內之該化學洗淨溶液導入該深淨槽內。

30.如申請專利範圍第23項之方法，當應用在噴洗式化學洗淨機上更包含多個容器用以盛裝不同的化學洗淨溶液。

31.如申請專利範圍第30項之方法，更包含多個管路用以將該多個容器內之該化學洗淨溶液導入該深淨槽內。

32.如申請專利範圍第23項之方法，當應用在濕式洗淨工作台上更包含多個深淨槽用以盛裝不同的化學洗淨溶液。

33.如申請專利範圍第23項之方法，係應用在刷洗機，或噴射系統中的洗滌過程。

34.一種氫氟酸蝕刻製程之後的晶圓深淨方法，該深淨方法係將一晶圓放在一單槽式洗淨機台上洗淨，該方法至少包含：

提供一容器，一深淨槽，一抽氣幫

浦，與一管路，其中該管路係用以連接該容器與該深淨槽，該抽氣幫浦係連接於該深淨槽上；

在該容器內提供去離子水；

5. 將該容器內之該去離子水通入該深淨槽；

以該抽氣幫浦對該深淨槽抽氣以降低該深淨槽內的壓力，使得該去離子水在該深淨槽中該晶圓以及微粒的表面形成氣泡，其中靠近該晶圓的微粒會被氣泡推離該晶圓的表面，而已經離開該晶圓表面的微粒會因為氣泡之間的斥力而不會回沾到該晶圓的表面上；及

10. 以超音波震盪位於該深淨槽內之該去離子水溶液。

35.如申請專利範圍第34項之方法，在該管路上更包含一閥，用以控制該管路的開關狀態。

20. 36.如申請專利範圍第34項之方法，在該深淨槽上更包含一排放口。

圖式簡單說明：

第一圖為洗淨機台中傳統的濕式洗淨工作台的示意圖；

25. 第二圖為洗淨機台中傳統的噴洗式化學洗淨機的示意圖；

第三圖為洗淨機台中傳統的單槽式洗淨機的示意圖；

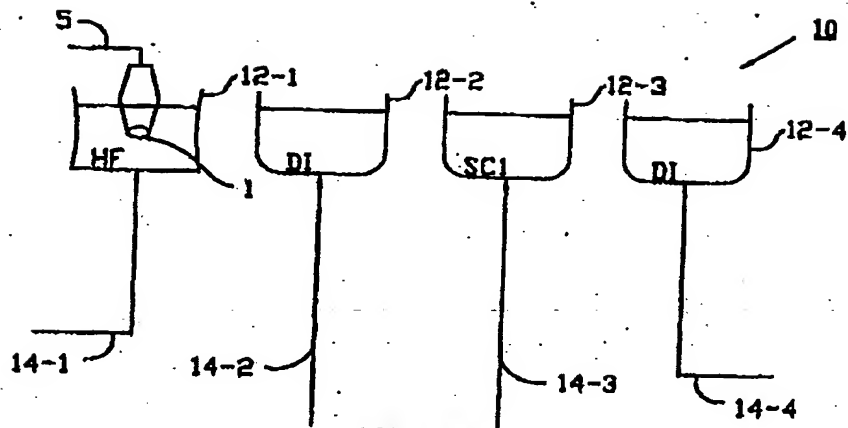
30. 第四圖為使用傳統的洗淨技術，在濕式洗淨工作台將晶圓取出時微粒附著在晶圓上的示意圖；

第五圖為使用本發明的技術，在清洗晶圓時氣泡將微粒晶圓表面的示意圖；

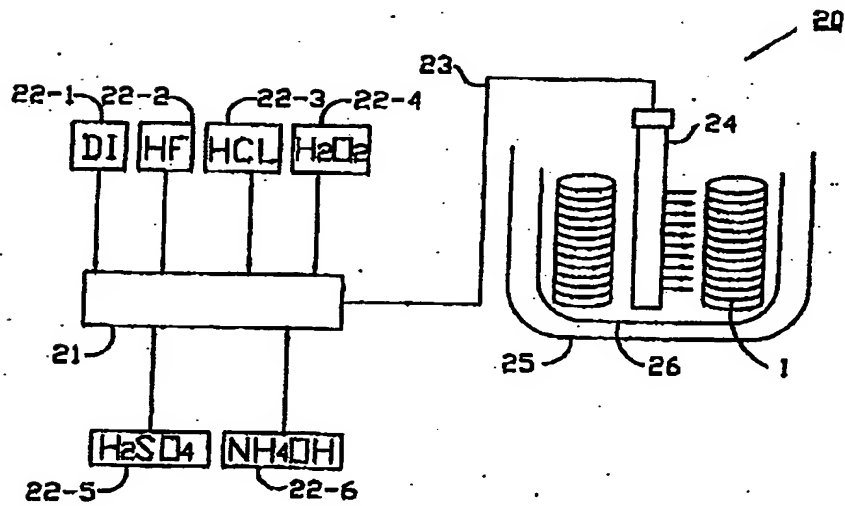
35. 第六圖為使用本發明的技術，係本發明的一種裝置示意圖；及

第七圖係根據本發明所揭露之技術，應用在單槽式洗淨機的示意圖。

(4)



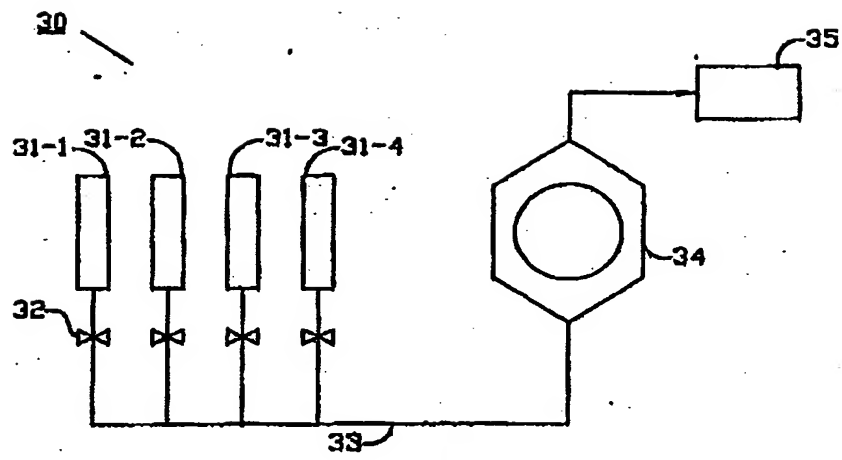
第一圖



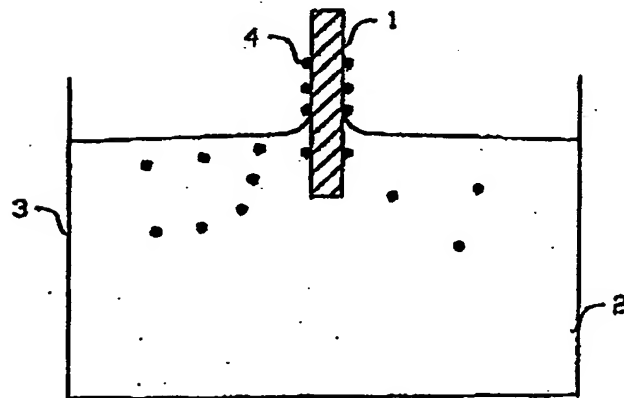
第二圖



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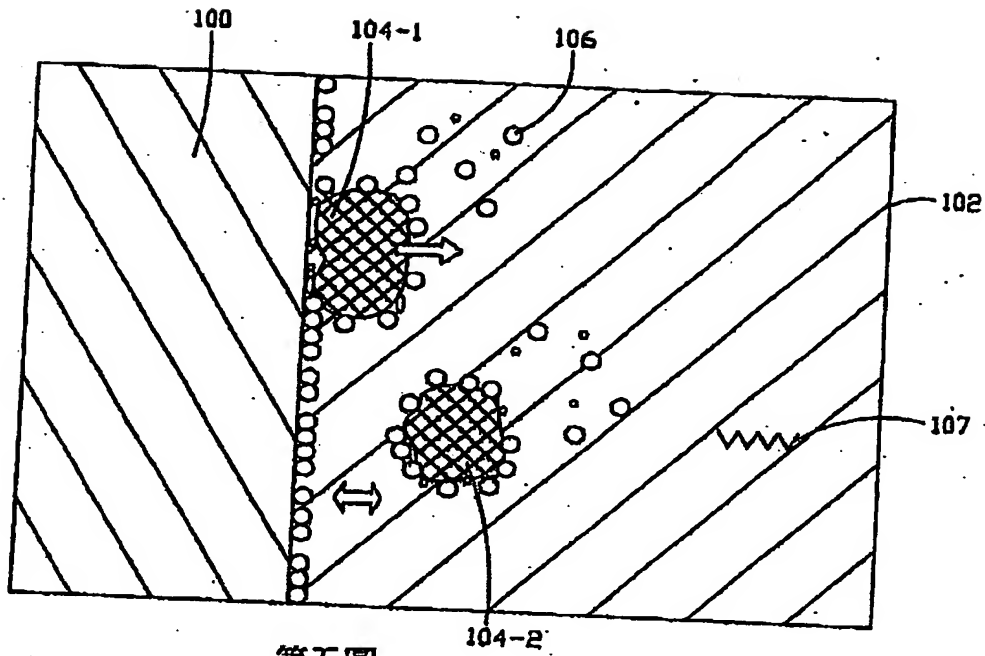


第三圖

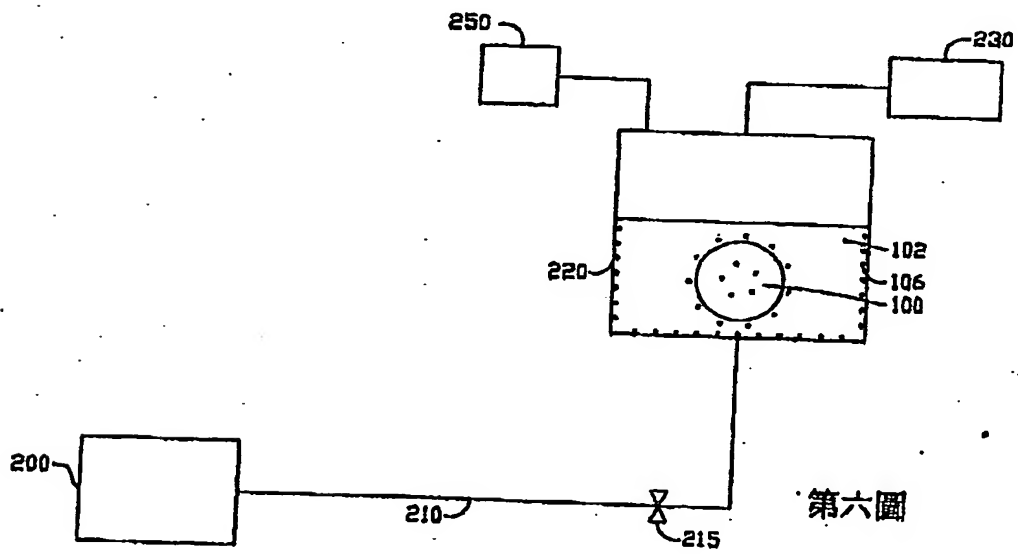


第四圖

(6)

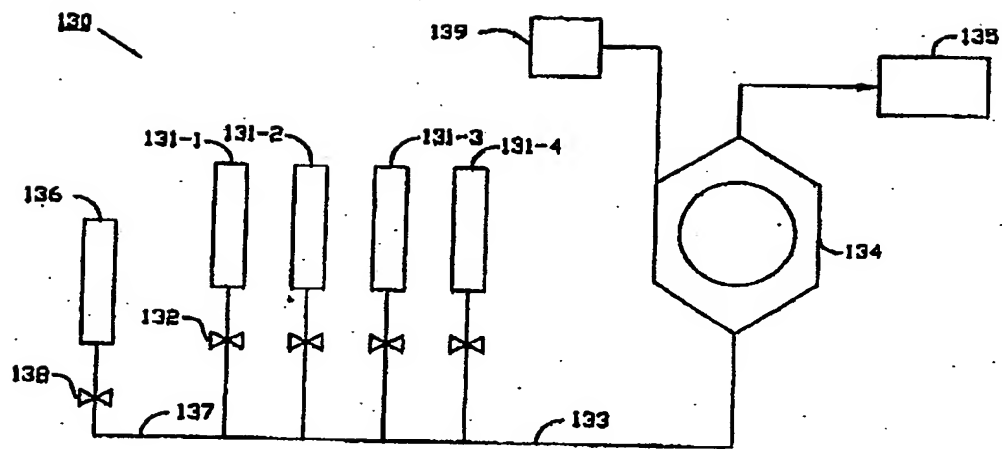


第五圖



第六圖

(7)



第七圖

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